

Notice of Allowability

Application No.

09/541,354

Examiner

Tiffany A Fetzner

Applicant(s)

YAIR ET AL.

Art Unit

2859

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 01/22/2004 & 04/08/2004.
2. ☒ The allowed claim(s) is/are 10-23 and 25-28.
3. ☒ The drawings filed on 03/31/2000 See attached approved Figs. are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date 04/12/2004.
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☒ Other See Continuation Sheet.

Response to Appeal Brief / Finality withdrawn

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action in **applicant's January 22nd 2004 appeal brief** is persuasive, and therefore, the **finality of that August 19th 2003 office action is withdrawn**, and prosecution of the instant application is hereby reopened.

Examiner's Amendment

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

3. Authorization for this examiner's amendment was given in a telephone interview with **Attorney Patrick Yoder Reg. No. 37,479** on April 8th 2004.

4. The application has been amended as follows:

In the title:

A) Delete the current title and **insert** "Switching Device to Linearly Conduct a Current between a **Gradient Amplifier and a Gradient Coil Assembly of an MRI System**".

In the claims:

B) Cancel claims 1-9 as per applicant's telephone election, without traverse of pending claims 10-23 and 25-28 on April 8th 2004, based on the telephonic interview of April 7th 2004, where a telephonic restriction requirement between Non-MRI pending claims 1-3, 5-9 and MRI pending claims 10-23, 25-28 was made by the examiner, in response to applicant's arguments of the January 22nd appeal brief. [See the formal restriction requirement in the Election / Restriction section below].

C) Replace claim 10 with the following **examiner amended claim 10**:

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10 "A magnetic resonance imaging (MRI) system **performing** an MRI scan in accordance with a pulse sequence, the pulse sequence including at least a first pulse, the system comprising:

a gradient coil assembly **generating** a gradient magnetic field during the MRI scan:

an amplifier **driving** the gradient coil assembly such that the gradient coil assembly generates the gradient magnetic field in accordance with the pulse sequence; and

a switch assembly **providing** a conductive path between the amplifier and the gradient coil assembly, the switch assembly comprising:

a first switching device having a conductive state during a first portion of the first pulse of the pulse sequence, the first portion dependent **only** on the magnitude of a current applied to the gradient coil assembly **by the driving amplifier**; and

a second switching device coupled in parallel with the first switching device, the second switching device having a conductive state during a second portion of the first pulse of the pulse sequence during which the current from the amplifier to the gradient coil assembly is below a non-zero threshold value,

wherein the conductive path is provided between the amplifier and the gradient coil assembly during substantially the entire duration of the first pulse."

D) **Replace claim 18 with the following examiner amended claim 18:**

18 "A magnetic resonance imaging (MRI) system acquiring MRI data, the system comprising:

a processor **controlling** acquisition of the MRI data in accordance with a program stored in a memory, the program including an imaging protocol having a sequence of gradient pulses and a sequence of detection pulses;

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a gradient amplifier **driving** the gradient coil assembly in accordance with the sequence of gradient pulses;

an MRI scanner **performing** an MRI scan, in accordance with the stored imaging protocol, the MRI scanner comprising a magnet, a gradient coil assembly, and an RF coil assembly, the gradient coil assembly generating a gradient magnetic field in accordance with the sequence of pulses;

a switch assembly coupled between the gradient amplifier and the gradient coil assembly **providing** a conductive path therebetween, the switch assembly comprising:

a first switching device having a conductive state during a first portion of the first pulse of the pulse sequence, the first portion dependent **only** on the magnitude of a current applied to the gradient coil assembly **by the driving amplifier**; and

a second switching device coupled in parallel with the first switching device, the second switching device having a conductive state during a second portion of the first pulse of the pulse sequence during which the current from the amplifier to the gradient coil assembly is below a non-zero threshold value,

wherein the conductive path is provided between the amplifier and the gradient coil assembly during substantially the entire duration of the first pulse; and

an RF detector coupled to the RF coil to detect MRI data resulting from the MRI scan in accordance with the sequence of detection pulses.”

D) Replace claim 23 with the following examiner amended claim 23:

23 “A method for performing a magnetic resonance imaging (MRI) scan with an MRI system including a gradient coil assembly, the MRI scan being performed in accordance with a pulse sequence, the method comprising:

receiving a pulse sequence;

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generating a current to drive the gradient coil assembly in accordance with the pulse sequence, the current comprising a plurality of current pulses;

conducting the current to the gradient coil assembly through a switch assembly, the switch assembly comprising a first switching device and a second switching device coupled in parallel with the first switching device;

placing the first switching device in a conductive state during a first portion of a first current pulse, the conductive state of the first switching device dependent **only** on the magnitude of the current applied to the **gradient coil assembly** during the first current pulse **by a driving amplifier**; and

placing the second switching device in a conductive state during a second portion of the first current pulse, such that the current is conducted to the gradient coil assembly during substantially the entire duration of the first current pulse wherein placing the second switching device in the conductive state occurs when the absolute value of the magnitude of the current applied to the **gradient coil assembly** is below a non-zero threshold value."

Election/Restrictions

5. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. **Claims 1-3, 5-9** drawn to a switching assembly to linearly conduct a current between a source and a load, classified in class 307, subclass 417 Art unit 2836.
- II. **Claims 10-23, 25-28**, drawn to An MRI system with an MRI gradient switching assembly to linearly conduct a current between a gradient amplifier and a gradient coil assembly of the MRI system, classified in class 324, subclass 318-322. Art unit 2859.

6. The inventions are distinct, each from the other because of the following reasons:

7. **Inventions I and II** are related as **combination and subcombination**.

Inventions in this relationship are distinct if it can be shown that (1) the

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combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the switching assembly of group I does not require the gradient coil assembly or the driving amplifier required by group II. The subcombination (i.e. Group II) has separate utility such as a magnetic resonance imaging system.

8. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

9. Because these inventions are distinct for the reasons given above and the search required for Group I (i.e. a search in class / subclass(es) 361/ 20, 100; 307/417; 318/138; and 327/461) is not required for Group II (i.e. class 324 subclasses 318-322), restriction for examination purposes as indicated is proper.

10. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

11. During a telephone conversation with Attorney Patrick Yoder on April 7th 2004 a provisional election was made without traverse via telephone election on April 8th 2004 to prosecute the invention of Group II, claims 10-23 and 25-28. Affirmation of this election must be made by applicant in replying to this Office action. **Claims 1-3, 5-9 and previously canceled claim 4** are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

12. The examiner notes that applicant requested that the examiner cancel **claims 1-9** by examiner's amendment on April 8th 2004. [See the examiner's Amendment above which cancels the non-elected claims.]

13. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at

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least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Examiner's Comment

14. The examiner notes that **claims 4, 24** were canceled as per applicant's April 3rd 2002 response.

Response to Arguments

15. The examiner agrees with the applicants arguments presented in the **January 22nd 2004 appeal brief**, as to the differences between the instant application and the prior arts of **Macovski et al.**, (i.e. that in **Macovski et al.**, switching is not based solely on the current between the MRI gradient coil assembly and the MRI driving amplifier because external signals, including cardiac gating signals, and pre-programmed routines also determine the state of the gradient switches), and **Van Groningen** (i.e. that the switching signals originate from components outside the circuitry components located between the MRI gradient coil assembly and the MRI driving amplifier). Therefore these references are no longer being applied as prior art against the claims of the instant application.

Drawings

16. The drawings filed 31 March 2000 have been approved by the examiner and the official draftsman.

The following is an examiner's statement of **Reasons for Allowance**:

17. The **examiner amended independent claims 10, 18, and 23** are considered to be allowable over the prior art of record because each of these claims contain the novel and non-obvious feature of "the switching device having a conductive state during a first portion of the first pulse of the pulse sequence, the first portion **dependent only on the magnitude of a current applied to the gradient coil assembly by the driving amplifier**; in combination with each of the other claimed limitations. It is the combined combination of every feature claimed that comprises the novelty in each of applicant's independent claims,

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and it the combination of limitations that distinguishes applicant's application from the prior art.

18. The **prior arts of record** do not teach, suggest, or show a MRI gradient assembly, that generates an MRI pulse sequence comprising a "switching device having a conductive state during a first portion of the first pulse of the pulse sequence, the first portion **dependent only on the magnitude of a current applied to the gradient coil assembly by the driving amplifier**; It would not have been obvious to one of ordinary skill in the art, at the time that the invention was made because in the prior art of record such as **Macovski et al., (the switch assembly is not dependent only on the magnitude of a current applied to the gradient coil assembly by the driving amplifier"**. In **Macovski et al.**, the switch assembly depends on signals received from many different sources including signals which are external to the gradient coil assembly (i.e. the external cardiac gating signals), and there is no teaching that the linearity of the switching device is improved by having the "switch assembly dependent only on the magnitude of a current applied to the gradient coil assembly by the driving amplifier". Applicant's examiner Amended independent claims require, in combination with the other features of the claims, that **the switch assembly is dependent only on the magnitude of a current applied to the gradient coil assembly by the driving amplifier"**, this feature teaches away from what is known in the art, and is therefore considered to be both novel and nonobvious by the examiner.

19. With respect to **dependent claims 11-17**, which depend from **examiner amended independent claim 10**, **dependent claims 19-22**, which depend from **examiner amended independent claim 18** and **dependent claims 25-28**, which depend from **examiner amended independent claim 23** each of these claims are considered to be allowable by the examiner because they depend from an allowable **examiner amended independent claim**, therefore the same reasons for allowance, novelty and nonobviousness, that apply to **examiner**

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amended independent claims 10, 18, and 23 also apply to **dependent claims 11-17, 19-22, and 25-28**, and need not be reiterated.

20. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Prior Art made of Record

21. The **prior art made of record** and not relied upon is considered pertinent to applicant's disclosure.

A) Macovski et al., US patent 5,835,995 issued November 10th 1998; filed October 28th 1996.

B) Van Groningen US patent 6,140,873 issued October 31st 2000 with an effective filing date of July 28th 1999;

C) Vavrek et al., US patent 5,311,135 issued May 10th 1994.

D) Mansfield et al., US patent 4,820,986 issued April 11th 1989;

Souza et al., US patent 6,144, 205 issued November 7th 2000 filed November 19th 1998.

E) Schweighofer US patent 6,034,565 issued March 7th 2000 filed July 21st 1998.

F) Schweighofer US patent 6,028,476 issued February 22 2000 filed July 21st 1998.

G) Ideler US patent 6,031,422 issued February 29 2000 filed August 4th 1998.

H) Schweighofer US patent 6,163,201 issued December 19th 2000 filed March 26th 1998.

I) Wirth et al., US patent 5,270,657 issued December 14th 1993.

J) Rohan et al., US patent 5,684,402 issued November 4th 1997; which shows circuitry for an MRI device with a gradient power supply and an imaging method. The examiner notes that the features amended by applicant are also suggested by this reference.

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K) Rohan et al., US patent 5,521,507 issued May 28th 1996 which shows circuitry for an MRI device with a gradient power supply and an imaging method. The examiner notes that the features amended by applicant are also suggested by this reference.

L) Davis US patent 4,047, 235 issued September 6th 1997. This reference is relevant to **non-elected claims 1-3**, and **non-elected claims 5-9** only, as it shows switching based on only the current flowing between a source and a load.

M) Cooke et al., US patent 5,528,444 issued June 18th 1996. This reference is relevant to **non-elected claims 1-3**, and **non-elected claims 5-9** only, as it shows switching based on only the current flowing between a source and a load.

N) Unnewehr US patent 3,697,839 issued October 10th 1972. This reference is relevant to **non-elected claims 1-3**, and **non-elected claims 5-9** only, as it shows switching based on only the current flowing between a source and a load.

O) Feige US patent 3,629,613 issued October 1st 1970. This reference is relevant to **non-elected claims 1-3**, and **non-elected claims 5-9** only, as it shows switching based on only the current flowing between a source and a load.

P) Morgan US patent 3,019,355 issued January 30th 1962. This reference is relevant to **non-elected claims 1-3**, and **non-elected claims 5-9** only, as it shows switching based on only the current flowing between a source and a load.

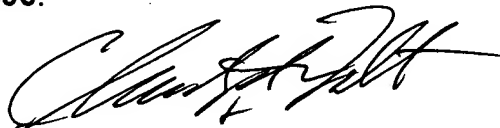
Conclusion

22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

23. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(703) 872-9306**.



TAF
April 10, 2004



Diego Gutierrez
Supervisory Patent Examiner
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CHRISTOPHER W. FULTON
PRIMARY EXAMINER